

EL CAPITAN BRIDGE

HAER NO. CA-101

Yosemite National Park Roads and Bridges

Spanning Merced River on El Capitan Crossover Road

Yosemite National Park

Mariposa County

California

HAER

CAL

22-YOSEM,

22-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

HISTORIC AMERICAN ENGINEERING RECORD

National Park Service

U.S. Department of the Interior

P.O. Box 37127

Washington, D.C. 20013-7127

HISTORIC AMERICAN ENGINEERING RECORD

EL CAPITAN BRIDGE
Yosemite National Park
HAER No. CA-101

HAER
CAL
22-YOSEM,
22-

I. INTRODUCTION

Location:

This bridge carries the El Capitan Crossover Road over the Merced River, approximately 2.5 miles southwest of Yosemite Village in Yosemite National Park, Mariposa County, California.

QUAD: EL CAPITAN, CA
UTM: 11/268180/4178250

Date of Construction:

1933

Designer and Builder:

Designed by the Bureau of Public Roads, U.S. Department of Agriculture.

Contractors: Sullivan & Sullivan;
later Kuckenberg & Wittman.

Original and Present Owner

Yosemite National Park, National Park Service.

Structure Type:

Steel girder and reinforced concrete bridge faced in logs

FHWA Structure No.:

8800-002P

Present Use:

Park road bridge

Significance:

El Capitan Bridge exemplifies the National Park Service "rustic style" of architecture. The structure is of steel I-beam construction, but is clad in heavy redwood timbers which give the bridge the appearance of log construction.

Project Information:

This document was prepared as part of the Yosemite Roads and Bridges Recording Project, conducted by the Historic American Engineering Record in summer 1991.

Richard H. Quin, Historian

II. HISTORY OF EL CAPITAN BRIDGE

El Capitan Bridge, spanning the Merced River in the middle of Yosemite Valley, appears to be constructed of massive redwood logs supported by bold masonry piers and abutments; actually, the structure is largely of structural steel and reinforced concrete construction, faced with native materials in the "rustic style" of architecture then prevailing for park structures.

The bridge is a three-spanned structure, 195' in length, constructed on a frame of steel I-beams supporting a reinforced concrete deck. The bridge rests on masonry abutments and two masonry piers. The piers and abutments are constructed of smooth boulders (taken in part from the river bed) and rest on poured concrete footings set over wooden pilings. The stones used are generally from 12" to 14" in height and from 18" to 48" in length and are set with their weathered surfaces exposed. They are bedded in mortar with the 1" to 1 1/2" joints raked out at least 1" deep. The steel I-beams that carry the main load of the bridge are masked from view by 42" diameter redwood log stringers supported on 42" sills resting on the abutments. These logs are not purely decorative, but help support the sidewalks/bridle paths on the sides of the deck. The concrete deck is covered with 9" of asphalt at the crown and has two expansion joints, each 1" wide, over the piers.¹

The first El Capitan Bridge was a 90' iron truss structure located about a mile downstream of the present bridge. When siting this structure, the ancient El Capitan moraine was blasted out to alleviate some flooding problems. (This was the first major alteration to the Valley landscape.) Originally called the "Lower Iron Bridge," by 1883 the structure had taken its present name after El Capitan, the great granite monolith above.² This bridge was destroyed by heavy snow loads in the winter of 1889-90 and its wreckage lay in the river for many years. Its replacement was a wooden truss bridge, designed with low sides so as not to obstruct the view for passengers in carriages.³

The bridge's floor was replaced in 1908.⁴ In 1912, Maj. William W. Forsyth, Acting Superintendent of the park, stated that the "El Capitan Bridge over the Merced River near El Capitan is now in a precarious condition and if not replaced soon by a new one will have to be closed for travel."⁵

The bridge was finally replaced in 1915 by new combination wood-and-steel Pratt through truss bridge with a total span of 87'6". The end posts and upper chords were hewed 12"x16" timbers, and the lower chords were paired 9" channel irons. The structure rested on solid concrete abutments. It was constructed by the California Construction Company of San Francisco at a cost of \$2,925. Costs borne by the Government for haulage and building of approaches brought the total price to \$3,025. The new bridge had a capacity of 12 tons.⁶

The south truss of the bridge failed in April 1930 and the structure was closed to traffic. As the National Park Service had five years previously contracted with the Bureau of Public Roads for the construction of new roads and road structures within the park system, the BPR was asked to oversee the construction of a replacement bridge. Surveys for the new structure were conducted in the summer of 1930, and test piles were driven in August. Plans for the bridge were drawn up in 1931 by the Bureau's San Francisco district office and the National Park Service's landscape architecture division.⁷ The BPR engineers designed the structure, and the NPS landscape engineers prepared the sheets of architectural details for the rustic-style structure.

The old El Capitan Bridge Road was removed in spring 1931, the work being completed in May. The old bridge abutments were taken out and the river bank was landscaped. Removal of the structure cost \$200, obliteration of the bridge site another \$875.97, and removal of the north portion of the road cost \$590.95.⁸ However, the old road route can still be traced. The present bridge is located about a mile upstream.

The contract for the building of the new bridge was combined with a contract for the construction of a new Stoneman Bridge [HAER No. CA-95] farther up the river. Bids for the new bridges were opened at the San Francisco district office of the Bureau of Public Roads on 20 October 1931, and the firm of Sullivan & Sullivan was awarded the work on 10 November. The Oakland, California contracting firm had submitted the low combined bid of \$106,862.40. By late November, the contractors had established a construction camp at the base of Bridalveil Fall, a site that had been used for other Valley road and bridge projects. They opened a new quarry site near the power house dam on the El Portal Road.⁹ Stone from this quarry was also used in the construction of Stoneman Bridge [HAER No. CA-95].

Specifications on the construction drawings indicate that the bridge was designed for a dead load of 150 lbs. per cu. ft., with an allowance of 15 lbs. per sq. ft. for future paving. The live load for the roadway was rated for three typical 15-ton trucks plus 30 percent for impact. The sidewalks and bridle paths were rated for 65 lbs. per cu. ft. The specifications estimated the following materials would be required for construction:

Class "A" Concrete	435 cu. yds.
Class "D" Concrete	100 cu. yds.
Class "S" Concrete	170 cu. yds. [*]
Reinforcing Steel	37,000 lbs.
Structural Steel	87,000 lbs.
Masonry	530 cu. yds.
Piling	8,640 lin. ft.
Untreated Timber	10.5 M.B.M.
42" diameter Redwood Logs	375 lin. ft.
Timber Rail	350 lin. ft.
Wet Excavation (Removed)	1480 cu. yds.
Dry Excavation (Removed)	420 cu. yds. ¹⁰

The roadway slab was to be poured with Class "D" concrete. Substructure work was to use a Class "A" mix, except for the seals, which would use a special Class "S" concrete. The reinforcing steel were to be deformed bars. Sawed timbers were to be prime structural redwood, and the pilings were to be local Douglas fir or cedar. All hardware was to be galvanized.¹¹

Actual work on the bridge began on 5 January 1932, with the building of coffer dams for the piers. These dams proved to be poorly constructed and were placed by equipment too light to drive them into the rocky river bed, so the project met with delays while heavier equipment was brought in. The quarrying for the stone for the masonry piers and abutments was carried out by a subcontractor, Kelly & Tipton; this work was underway with good progress by late January. In addition to the rock taken from the quarry, some boulders were used in the masonry piers and abutments; these were taken from the El Capitan moraine at the old bridge site a mile downstream.¹²

* Classes of concrete refer to the amount of Portland cement used in the mixture, with Class "A" having the highest proportion and so on. Class "S" concrete was a special mix used for the bridge seals.

To make up for the late start and early delays in the project, Sullivan & Sullivan went to two shifts, but produced no better results. Similar delays were encountered on the Stoneman Bridge project. T. M. Roach, the resident engineer for the Bureau of Public Roads, was convinced that the firm had little experience in the building of bridges, especially in foundation work. On 20 February 1932 he terminated their contract; the work on the two bridges was only 6 percent complete.¹³

The National Surety Company, which had issued bonds for Sullivan & Sullivan, was called upon to complete the work under the contract. They engaged the Portland, Oregon construction firm Kuckenberg & Wittman (who had submitted the second lowest bid for the project) to perform the remaining work. Kuckenberg & Wittman began work on both bridges on 21 March.

As the two planned piers were both in the river, caissons were employed in the excavation of their footings. These were put in place in March 1932. At the same time, wooden piles were being driven for the falsework. On 19 April, workers began excavation for pier #2. Soon afterwards, spring floods carried off the falsework. A coffer dam was put in place in May so that work could resume on pier #2. Another round of flooding in June delayed work on the pier until July.¹⁴ Construction of the bridge remained plagued with such setbacks.

Walings and a cofferdam for the construction of abutment #1 were started on 13 June. The remaining piles for the bridge were driven in July, and work began on the abutments. By summer's end, abutment #1 was complete except for the masonry veneer, and footings for abutment #2 and pier #2 were being constructed. The placing of the masonry facing, under subcontractor Kelly & Tipton, commenced in the fall, and by November, the bridge seats had been placed and the steel I-beams, made by Bethlehem Steel and supplied by the McClintic-Marshall Company of San Francisco, had arrived. The steel was then put in place and the concrete deck was poured. The concrete was comprised in part of a coarse aggregate made from diorite (a veined granite) taken from the excavation of the Wawona Tunnel, and sand from a pit in Leidig Meadow. By the end of the month, the contractors were ready to place the redwood log stringers. These logs, which were supplied by the Hammond Lumber Company of Eureka, California, were placed in notches carved in the wooden sills and supported by 12" diameter log braces and attached with 1" diameter anchor bolts. The seven-foot sidewalks/bridle paths, comprised of 2"x6" laminated wooden lumber topped by 1/2" of asphalt, were laid by the end of the year. Redwood guard rails, consisting of an 8" rail set 2' over a 12" log sill, extending between 24" diameter post at irregular spaces and supported by 6" dowels and 15" interval posts, were built along the sides.¹⁵

The project was completed and accepted on 8 January 1933, representing an overrun of a full 170 days. The bridge still had not been paved; this work was to be done by day labor under supervision of the Bureau of Public Roads. Due to the onset of winter weather, no more work was done until early spring.¹⁶

Backfill for the approaches was placed in March and April, and paving commenced. The paving work was completed on 27 May 1933 and the bridge was opened to traffic.¹⁷

Rip-rap to protect the river bank around the bridge came from border stones that had originally been placed along the Valley roads in the neighborhood of Camp Curry and Yosemite Village to deter motorists from driving in the meadows; Superintendent Charles Goff Thomson had found the appearance of these

stones annoying, and ordered them moved and used at the bridge.* To hide some of the damage to the river bank caused by the bridge construction, Emergency Conservation Works personnel landscaped the approaches in 1934, planting willow switches and seeding native plants.¹⁸ Following the bridge's completion, eight new road signs were placed to mark the new El Capitan Crossover.¹⁹

Severe flooding on the Merced River on 11 December 1937 tore the guard rail and log sides off the bridge; these were replaced in May 1938.²⁰ The logs were again replaced in 1979 or 1980, and at about this time, the wooden guard rails were replaced with aluminum rails to the general detriment of the bridge's appearance. The wooden sidewalks were covered with asphalt.

El Capitan Bridge was resurfaced in the fall of 1960 by Harm Brothers Construction Company. The hot plant mix was obtained from the Mariposa Sand and Gravel Plant at El Portal. The surface treatment was part of a larger contract that also included the paving of the Wawona Tunnel and the lower part of the Glacier Point Road between Chinquapin Flat and the entrance to the Badger Pass Ski Area.²¹ After heavy flooding in late 1964, the north approach to the bridge was raised to avoid future high water.

Park superintendent Thomson had urged that the new El Capitan Bridge be built to resemble a log bridge, as he felt that the further construction of stone arch bridges in the Valley would seem repetitious (although he oversaw the construction of the stone-arched new Stoneman Bridge at about the same time). The new El Capitan Bridge is constructed of steel and reinforced concrete, but the stone piers and abutments and the log stringers on the sides give the bridge the appearance of being built from native materials, making the structure a powerful example of the National Park Service's "rustic style" of architecture, which dictated that buildings and structures be constructed to harmonize with the natural surroundings.

* Border stones are again being used in some places around the Valley to deter vehicles.

III. ENDNOTES

1. Bureau of Public Roads, "El Capitan Bridge, Yosemite National Park Project 1-B2," construction drawings RG 276-A, sheets 1-4 & 6, July 1931, and National Park Service Landscape Division, "El Capitan Bridge, Yosemite National Park," architectural plans, 22 August 1931. Copies in Park Landscape Architect's office, Yosemite National Park. Measurements confirmed by HAER field survey, June 1991.
2. George M. Wheeler, "Topographical Map of the Yosemite Valley and Vicinity," U.S. Army Corps of Engineers, 10 November 1883.
3. Greene, I:69n.
4. *Ibid.*, I:416.
5. William W. Forsyth, Major, Sixth Cavalry, *Report of the Acting Superintendent of the Yosemite National Park to the Secretary of the Interior*, 1912 (Washington, D.C.: Government Printing Office, 1912), 8.
6. Mark Daniels, "Report of the Landscape Engineer of the National Parks," in *Reports of the Department of the Interior*, 1915, 2 vols. (Washington, D.C.: Government Printing Office, 1916), I:850; Charles Goff Thomson, Superintendent, Yosemite National Park, "Final Report #74, El Capitan Bridge Removal," October 1931, 1 (copy in Yosemite National Park Maintenance and Engineering Office); *Report of the Superintendent of the National Parks to the Secretary of the Interior*, 1916 (Washington, D.C.: Government Printing Office, 1916), 790; David Shurfey, "Park Engineer's Report," in *Report of the Superintendent of the Yosemite National Park to the Secretary of the Interior*, 1915 (Washington, D.C.: Government Printing Office, 1915), 24.
7. A. W. Schimberg, "Final Construction Report, Stoneman and El Capitan Bridges, Yosemite National Park, Mariposa County, California" (San Francisco, CA: Bureau of Public Roads, 11 May 1933), 2.
8. Charles G. Thomson, Superintendent's Monthly Report, May 1931, 10; Idem, "Final Report #74," 1.
9. Schimberg, 3-5; Charles Goff Thomson, Superintendent's Monthly Report, October 1931, 8; Superintendent's Monthly Report, November 1931, 8; Superintendent's Monthly Report, December 1931, 7.
10. El Capitan Bridge construction drawing RG 276-A, sheet 1.
11. *Ibid.*
12. Schimberg, 5-6.
13. *Ibid.*, 6.

14. Schimberg, 8-10; Thomson, Superintendent's Monthly Report, March 1932, 6; Superintendent's Monthly Report, May 1932, 7.
15. Schimberg, 11-18; Thomson, Superintendent's Monthly Report, July 1932, 10; Superintendent's Monthly Report, August 1932, 8; Superintendent's Monthly Report, October 1932, 7; Superintendent's Monthly Report, November 1932, 7; Superintendent's Monthly Report, December 1932, 9; BPR construction drawings RG 276, sheets 1-2, 6.
16. Thomson, Superintendent's Monthly Report, July 1932, 10; Superintendent's Monthly Report, August 1932, 8; Superintendent's Monthly Report, October 1932, 7; Superintendent's Monthly Report, November 1932, 7; Superintendent's Monthly Report, December 1932, 9.
17. Idem, Superintendent's Monthly Report, March 1933, 9; Superintendent's Monthly Report, April 1933, 9; Superintendent's Monthly Report, May 1933, 11.
18. Idem, Superintendent's Monthly Report, February 1934, 10.
19. Idem, Superintendent's Monthly Report, August 1932, 16.
20. Lawrence C. Merriam, Superintendent's Monthly Report, May 1938, 10f.
21. Harlan D. Unrau, *Historical Overview and Assessment of Significance of Stone Walls and Rock Work Along Glacier Point Road in Yosemite National Park*. (Denver, CO: National Park Service, Denver Service Center, January 1990), 37.

IV. BIBLIOGRAPHY

PUBLISHED GOVERNMENT DOCUMENTS

Daniels, "Report of the Landscape Engineer of the National Parks," in *Reports of the Department of the Interior*, 1915. 2 vols. Washington, D.C.: Government Printing Office, 1916. Vol. I.

Forsyth, William W. *Report of the Acting Superintendent of the Yosemite National Park to the Secretary of the Interior*, 1912. Washington, D.C.: Government Printing Office, 1912.

Greene, Linda Wedel. *Yosemite, The Park and Its Resources: A History of the Discovery, Management, and Physical Development of Yosemite National Park, California*. 3 vols. Washington, D.C.: National Park Service, 1987.

Shurfey, David, "Park Engineer's Report," in *Report of the Superintendent of the Yosemite National Park to the Secretary of the Interior*, 1915. Washington, D.C.: Government Printing Office, 1915.

Report of the Superintendent of the National Parks to the Secretary of the Interior, 1916. Washington, D.C.: Government Printing Office, 1916.

Unrau, Harlan D. *Historical Overview and Assessment of Significance of Stone Walls and Rock Work Along Glacier Point Road in Yosemite National Park*. Denver, CO: National Park Service, Denver Service Center, January 1990.

UNPUBLISHED GOVERNMENT DOCUMENTS

Bureau of Public Roads. "El Capitan Bridge, Yosemite National Park Project 1-B2." Construction drawings RG 76 A&B, Sheets 1-4 and 6, July 1931. Copies in Park Landscape Architect's office, Yosemite National Park.

Merriam, Lawrence C. Superintendent's Monthly Report, May 1938.

National Park Service Landscape Division. "El Capitan Bridge, Yosemite National Park." Architectural plans, 22 August 1931. Copies in Park Landscape Architect's office, Yosemite National Park.

Schimberg, A. W. "Final Construction Report, Stoneman and El Capitan Bridges, Yosemite National Park, Mariposa County, California." San Francisco: Bureau of Public Roads, 11 May 1933.

Thomson, Charles Goff. "Final Report #74, El Capitan Bridge Removal," October 1931. Yosemite National Park Maintenance and Engineering Office.

--Superintendent's Monthly Report, May 1931.

--Superintendent's Monthly Report, October 1931.

--Superintendent's Monthly Report, November 1931.

--Superintendent's Monthly Report, December 1931.

--Superintendent's Monthly Report, January 1932.

--Superintendent's Monthly Report, February 1932.

- Superintendent's Monthly Report, March 1932.
- Superintendent's Monthly Report, May 1932.
- Superintendent's Monthly Report, July 1932.
- Superintendent's Monthly Report, August 1932.
- Superintendent's Monthly Report, November 1932.
- Superintendent's Monthly Report, December 1932.
- Superintendent's Monthly Report, March 1933.
- Superintendent's Monthly Report, April 1933.
- Superintendent's Monthly Report, February 1934.

Wheeler, George M. "Topographical Map of the Yosemite Valley and Vicinity."
U.S. Army Corps of Engineers, 10 November 1883.

SECONDARY SOURCES

Sargent, Shirley. Galen Clark: Yosemite Guardian. San Francisco, Sierra Club, 1964.